Extended Abstract

Current Mission Design for the SIRTF Mission

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The Space Infrared Telescope Facility (SIRTF) was most recently scheduled to launch on July 15, 2002[1]. Due to project delays, SIRTF is now slated to launch on January 9, 2003. Using a Delta 7920H launch vehicle and a direct ascent trajectory, SIRTF will launch into an Earth-trailing solar orbit at which point it will begin a 2.5 to 5 year mission. During its mission, SIRTF will be performing some of the best infrared astronomy to date. This paper presents the latest trajectory data, injection dispersion analysis performed to guarantee SIRTF will be injected into an acceptable orbit (SIRTF has no onboard propellant for trajectory correction), asteroid searches, and other new topics relating to the SIRTF mission design.

Introduction

The Space Infrared Telescope Facility (SIRTF) is a cryogenically-cooled observatory that will perform infrared astronomy during its 2.5 to 5 year lifetime. SIRTF is the final facility to be launched as part of NASA's four Great Observatories and a cornerstone of NASA's Origins program. SIRTF is scheduled to launch on January 9, 2003 on a Delta 7920H from Cape Canaveral. The observatory will be launched into an Earth-trailing solar orbit at which point it will begin to slowly drift away from the Earth until the end of its mission. The observatory has no onboard propellant for trajectory correction maneuvers. As a result, the SIRTF trajectory must be flexible enough to accept any orbit that the launch vehicle puts the observatory in.

The New Baseline Trajectory

SIRTF has numerous trajectory constraints that, while they define its acceptable trajectories sufficiently, are not considered part of the 'typical' optimization process for most trajectories that leave Earth's gravity potential. Due to light and heat sensitive

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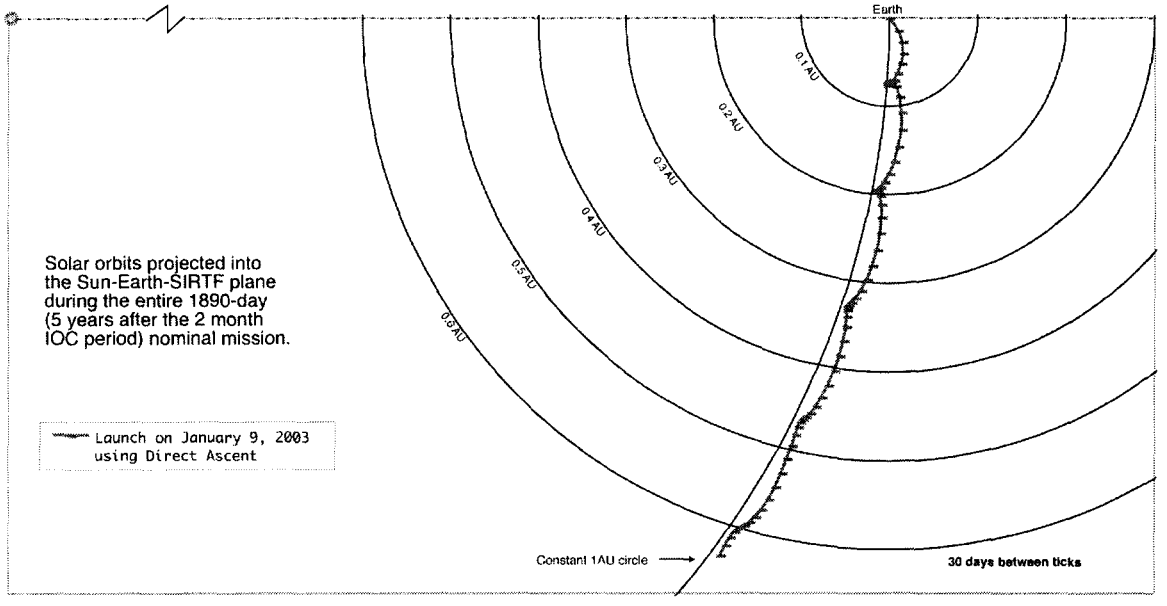
equipment, SIRTF must strictly maintain its orientation in an attitude space described by the Operational Pointing Zone[1] (OPZ). The result of this constraint is that the Sun-Probe-Earth angle must be 52° by day 30, and must remain between 52° and 92° for the length of the nominal mission (2.5 years) and the extended mission (5 years). Additionally, the maximum range to Earth must be less than .64 AU after 5 years. Figure 1 provides a picture of the SIRTF baseline trajectory. This figure plots the trajectory in a rotating coordinate system with the Earth-Sun line fixed to the left.

Figure 1 The Baseline 95° Azimuth Direct Ascent Trajectory for SIRTF in a Rotating Coordinate Frame.



Analysis

This paper will introduce the new launch period for SIRTF. We will also discuss the injection dispersion analysis that was done to verify that SIRTF's trajectory is robust enough to handle a 3-sigma dispersion in our injection. A detailed analysis is also performed to show what asteroids SIRTF will get close to during the length of its mission.

Additionally, we will present work that has been done to assure that the dust cover and the second stage will get sufficiently far from the observatory so as not to interfere with SIRTF's science (since SIRTF has no onboard propellant, the trajectory cannot be biased from the dust cover and the second stage). This paper will also cover other relevant mission design work that has been done for SIRTF.

References

[1]Garcia, M. D., "SIRTF Trajectory Design and Optimization," Paper AAS 01-174, Santa Barbara, CA, Feb.11-15, 2001.